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Environmental economics and the Murray-Darling

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CIES DISCUSSION PAPER 0214

Environmental economics and the Murray-Darling

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In an excellent and interesting article, John Quiggin surveys the environmental issues of the Murray-Darling basin and, citing the relevant economic literature, proposes an eclectic approach to their solution. Quiggin's preferred policy framework involves three elements: taxing the polluter, creation of new forms of communal property rights (to encourage Coasian bargaining or internalisation) and regulation (also to assist in achieving sustainability).

I make three connected comments. Firstly, Buchanan and Stubblebine (1962) showed that the combination of Pigovian taxation and Coasian bargaining, of the kind that Quiggin wishes to encourage, can be inconsistent, in that bargaining can move the economy away from the Pareto efficient allocation that would be achievable by taxation alone. My second comment revolves around the dual meanings of the words 'unilateral' and 'reciprocal'. Quiggin concentrates on externalities that are unilateral in a physical sense. In contrast, Coase (1960) assumes as a practical matter that externalities are reciprocal in an economic sense. If so, it tells against many strong claims in favour of specific forms of public intervention—Coase claimed regulating the polluter, or awarding damages against the polluter, or taxing the polluter will *not necessarily* improve the efficiency of the allocation of resources. My final remarks relate to the concept of efficiency used by Quiggin and Coase, and how Quiggin's economics leads him to what I take to be the central message in Coase (1960). My comments relate only to efficiency and not directly to equity considerations¹; and not to Quiggin's argument concerning the value of notions of sustainability.

Turn now to the first issue: that Coase's 1960 analysis of *bargaining* solutions would "trump" the Pigovian tax, even in cases when the Pigovian tax is in fact optimal. The argument is illustrated in Figure 1, adapted from Figure 2 of Buchanan and Stubblebine (1962). There is an activity in quantity Q that person A can decide upon, which benefits A and harms person B. The benefit and harm are shown as marginal evaluations, with ME_A measured conventionally, and ME_B shown for convenience as its negative. Assume that there is nothing that B can do to relieve or increase her hurt. Left to herself, A will choose quantity Q_1 . With a Pigovian tax schedule in place, $ME_A - ME_B$ becomes A's marginal evaluation schedule, post tax, and Q_2 becomes A's independent adjustment equilibrium, post tax.

However, there is a Coasian twist that links tax remedies with Quiggin's advocacy of reforms in property rights. At Q_2 the *private* marginal evaluations of A and B differ (zero, for A; less than zero, for B). Say that a change in property rights so improves the climate for Coasian bargaining that it becomes costless. The damaged party, B, pays the polluter, A, to reduce Q until the

¹ In his section on property rights, Quiggin's emphasis shifts from efficiency to equity. However, the bulk of his argument is about efficiency.

quantity becomes Q_3 . Buchanan and Stubblebine call a point like Q_3 a “Pareto equilibrium” (p. 380), meaning, I think, that there are no more feasible “gains from trade” to be made. Alternatively, it could be called the Coasian equilibrium under the Pigovian tax regime.² (Note that, because tax revenue falls, the movement from Q_2 to Q_3 is not a Pareto improvement.)

This example simply assumed away the issue of the reciprocal nature of externalities, to which we now turn. In his section entitled “Externality”, Quiggin wrote that “A second crucial distinction is that between unilateral and reciprocal or congestion externalities. Unilateral externalities arise when the actions of one party generate externalities affecting another, *but not vice versa*. To the extent that the actions of upstream users degrade water quality for downstream users, the salinity problem may be viewed as a unilateral nonpoint externality...The externality framework is most valuable in the consideration of unilateral externalities.” Similarly, when discussing property rights, Quiggin asserted that “Coase discussed unilateral externalities involving two parties.” (pp. 77-8, emphasis added).

A Coase-like example will do to illustrate the reciprocal nature of externalities, when considered from the viewpoint of the devising of policies to improve allocative efficiency. A man increases the height of a chimney, which has the effect of polluting the air of another property owner. For efficiency reasons, and without further economic inquiry, should the chimney owner be forced to close his chimney or to modify its use, so as to restore the air quality previously enjoyed by his neighbour? Or should a tax be levied, so that the polluter pays?

Surely it is obvious that the actions of building and using the chimney are what caused the externality. Well, no. If the polluted party were to close his door or window, or to install an air filter, or to live somewhere else, then the externality would be ameliorated and possibly completely removed. The crucial economic fact is that the actions or inactions of *both* parties jointly cause the externality problem. The reciprocity of “unilateral externalities” consists in the fact that the damage caused to the injured party depends on the actions and inactions of that party, as well as on the actions and inactions of the polluter. Through this reasoning, applied in numerous examples, Coase argued that various legal or

² There is a different Coasian (or costless bargaining) equilibrium for each different tax regime, and a different optimal Pigovian tax for each bargaining situation. In particular, the Coasian equilibrium under the no-tax regime is Q_2 , and the optimal Pigovian tax with costless bargaining is zero. As to the Pareto optimality of Q_2 and Q_3 in Figure 1: Q_2 is P-O when bargaining between A and B is costless and no pollution tax has been imposed; and Q_2 is also P-O when no bargaining can take place and the tax schedule ME_B is imposed. However, Q_3 is P-O if bargaining is costless and the Pigovian tax schedule ME_B is imposed; and is Q_3 is also P-O if there is no bargaining between A and B, and if a tax schedule suitably heavier than ME_B is imposed. (The required tax schedule, not drawn, would impose a tax of ME_A if output is Q_3 .)

property rights or regulatory “remedies” would *not necessarily* improve matters.

Turn to Quiggin’s central example of upstream users whose activities adversely affect downstream users. According to Quiggin, the upstream users are the generators of a unilateral externality. By this he meant that the downstream users—and this claim is crucial—are doing nothing to harm the production of the upstream users.

However, a legislative, fiscal, regulatory or legal remedy, afforded the downstream producers, does harm upstream users. It would contribute to economic efficiency only if such a remedy caused an increase in the downstream net production or surplus greater than the induced fall in upstream surplus.³ In thinking about this cost-benefit test, note that, once the remedy is in place, the downstream producers, actual or potential, when deciding on their level of activity, need not take into account the harm that they do to the upstream producers (via the operation of the remedy). As in the chimney example, such a remedy may do more harm than good.

Remember that I am focusing entirely on economic efficiency. Coase’s index of economic efficiency is the value of net product; Quiggin’s is similar (aggregate net surplus); both are practical versions of the cost-benefit or Hypothetical Compensation Principle. To achieve improvements in efficiency on these criteria, we should choose the policy or legal remedy that generates the largest social product (or surplus). For non-tax remedies, this requires assessing the costs and benefits of all possible actions of both parties; choosing the set of actions that maximises aggregate net benefit; specifying the feasible policy action that would implement the maximising allocation. (The consequences of reciprocity for taxation are considered later). As an example, Quiggin (2001) reports on work in Quiggin (1988), which made a comparison between the allocation that maximises the sum (S^*) of upstream and downstream surpluses and the allocation that maximises the upstream surplus first (S_U), and then the downstream surplus (S_D). The difference between S^* and $S_U + S_D$ Quiggin identifies as the “social loss associated with the upstream-downstream externality”; or as the difference between a regime with “common property” and a regime of “open access” (2001, p. 80).

Running a cost-benefit study of all feasible actions is a difficult task; but what are the alternatives? Rules of thumb or legal rules? Coase was sceptical that judges or policy makers can, *in every instance*, select the remedy that achieves the most efficient outcome. What has attracted the most attention in Coase’s article is his discussion of situations in which a judge and a policy maker need

³ This is a simplification which assumes, for example, that the Murray-Darling is an isolated system.

do nothing. When the affected parties will negotiate a Pareto-improving change, it does not matter to whom property rights are awarded (if that were the remedy under consideration). That is, when transaction costs are low enough, a tax “on the externality” would be otiose at best, as the discussion of Figure 1 illustrates.⁴

The fame of the “Coase theorem” is despite the fact that the bulk of Coase’s 1960 article is about hard cases, when spontaneous solutions cannot be relied upon. Concerning these, Coase set out to throw doubt on the belief in the *efficacy of any single or simple rule* (like the rule of first settlement, as in the case of the country estate troubled by an airfield; or the rule that ‘the polluter must pay’; or the rule of “do nothing”).

How then to reduce the social loss? Quiggin earlier (1988) discussed a corrective policy very like a Pigovian tax on the upstream producers (namely, to raise the price of water). At the end of his 1960 article, Coase included Pigovian taxation in the class of remedy against which his strictures apply: “A tax system which was confined to a tax on the producer for damage caused would tend to lead to unduly high costs being incurred for the prevention of damage. Of course this could be avoided if it were possible to base the tax, not on the damage caused, but on the fall in the value of production (in the widest sense) resulting from the emission of smoke. But to do so would require a detailed knowledge of individual preference and I am unable to imagine how the data needed for such a taxation system could be assembled” (p. 41). As Ng (2002) has pointed out, Coase was wrong about taxation, in that the introduction of an infinitesimal tax on A’s activity must improve efficiency, as Coase defined efficiency improvements. To illustrate, at Q_1 in Figure 1, which is A’s independent adjustment equilibrium before the tax, A’s marginal valuation of her own activity is zero, while B’s valuation must be negative; therefore, a marginal fall in A’s activity harms A less than it benefits B (and some tax is collected, also). To go confidently beyond an infinitesimal rate, detailed knowledge is required (eg, through policies, if such exist, that induce truthful revelation of all the required information).

Conclusions: There is a theorem which says that, whatever the allocation of endowments (including property rights), a decentralised process of decision making can achieve an efficient outcome through markets. It is the first fundamental theorem of welfare economics, which becomes the “Coase theorem” when the words “through markets” are replaced with “through voluntary exchange”. The theorems do not say that the voluntary exchange outcome is the best of all possible worlds; merely that policy—be it regulatory,

⁴ On taxation, see the previous note. Coase (1960) has a discussion of the externality caused to a business, by a machine located adjacent in the same building. An efficient solution maybe involves modifications on the side of the injured party (and a side payment).

legislative, judicial, or any imposed solution, will hurt some and possibly help others. That is, imposed solutions cannot generate Pareto improvements (except by chance). In particular, starting from zero, a marginal tax on the activity that generates the pollution will satisfy the hypothetical compensation principle, but will not be a Pareto improvement. Person A will lose and would have selfish grounds to oppose the change.

This is not to imply that all such impositions are necessarily bad or unjustifiable, but that they are not justified on the Paretian criteria for improvements in economic efficiency. The approach called Constitutional Political Economy, pioneered by Buchanan and Tullock, and developed by Brennan and Buchanan, explores in economic terms the idea of exchange of agreements about rules of society (“the social contract”)—applying the Paretian criterion at one remove from ordinary policy-making. For example, if people are risk averse, as is assumed in Quiggin’s expression on p. 81, behind the veil of uncertainty they would not agree to market or policy rules designed to maximise the sum of surpluses in all instances; would not agree to the unbridled operation of the hypothetical compensation principle; especially if the incidental redistributions are random or regressive with respect to initial levels of individual well-being, and large relative to the aggregate gains made. But they would agree to *some* rules that forced them to do, in some circumstances, what they would not otherwise do voluntarily.⁵

There is in Quiggin (2001) an interesting discussion of possible ways to reduce the social loss, other than taxes on polluters. Instanced is Dudley’s 1992 proposal to define water drawing-rights in terms of shares of the capacity of the storage, rather than as rights to non-contingent amounts of water for delivery on demand. As Quiggin correctly points out, instability of property rights encourages ‘rent seeking’ aimed at securing a reassignment of rights; *ditto*, for taxes and subsidies. Turning Hayek (1945) on his head, Quiggin (2001, p. 88) makes the point that the economic information required to assign property rights efficiently in the first place, and once and for all, is the very information required for detailed central planning; *ditto*, for Pigovian tax schedules that take into account the costs of all possible actions and inactions of all the players, actual and potential (as Coase claimed in the quotation cited earlier). That is to say, the search for simple but invariably efficiency-improving policy rules, as well as the search for perfect assignments of unchangeable property rights, are

⁵ For example, they might agree to the pragmatic policy regime, to which I am attracted, under which environmental problems that are large, and singular, merit considerable detailed research and investigation (for tailored solutions); that any class of middle-sized environmental problems, with common characteristics and with large numbers of examples in the class, warrants some search for rule-based or ‘generalised’ solutions (like zoning); and that other problems are probably best left alone (or to the courts). This policy regime requires methods for deciding into which class a problem falls.

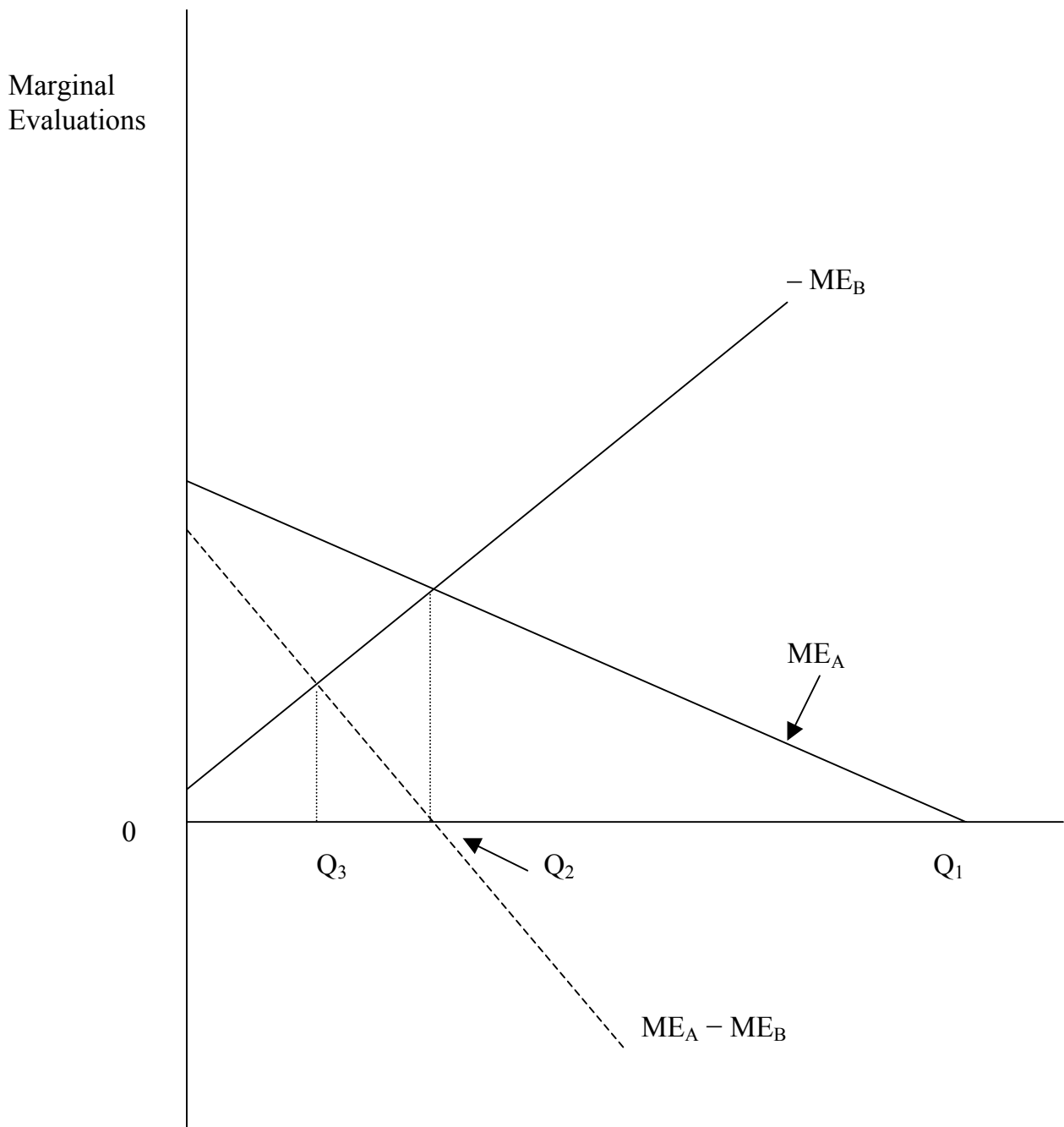
quests for chimeras. But this is exactly what I read into Coase (1960), and Quiggin.⁶

⁶ “As the expansionary phase drew to a close and problems of the mature water economy became evident, the need for appropriate economic institutions became apparent. Indeed, there was some tendency to suggest that the resolution of the problems was a simple matter of getting prices right (or, from a Coasian perspective, creating clearly defined property rights). The experience of the last decade has shown that appropriate economic institutions are essential, but that the complexity of the problem is such that *no simple policy solution is likely to prove adequate*” (Quiggin, 2001, p. 90, emphasis added).

References

- James M. Buchanan and Wm. Craig Stubblebine (1962), "Externality", *Economica*, N.S., Vol.XXIX, No. 116, pp. 371-84.
- R.H. Coase (1960), "The problem of social cost," *The Journal of Law and Economics*, Vol III, pp. 1- 44.
- F.A. Hayek, (1945), "The use of knowledge in society," *American Economic Review* 35, pp. 519-30.
- Yew-Kwang Ng, (2002) "Externality, Pigou and Coase. A case for bilateral taxation and amenity rights," Monash University.
- John Quiggin (1988), "Murray River salinity – an illustrative model," *American Journal of Agricultural Economics*, vol. 70, pp. 635-45.
- John Quiggin, (2001), "Environmental economics and the Murray-Darling river system," *The Australian Journal of Agricultural and Resource Economics*, 45:1, pp. 67-94.

Figure 1



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